

other. The invention as claimed in claim 1 defines that:

- the second connecting portion 7 of the at least one part 6, 28 is comprised of polyfluorocarbon;
- the surface of the second connecting portion 7, comprised of polyfluorocarbon, is activated by plasma activation to form a plasma-activated surface;
- the plasma-activated surface connects the at least one support member 1 and the at least one part 6, 28 to form a permanent adhesive connection.

The claim sets forth connecting one F containing compound to another unspecified component. The applicant has stated nothing else. The prior art Okumura does not show joining two F components to one another. The examiner's remark is irrelevant in this context as joining two F containing parts is not an issue.

On page 3, first and second paragraphs, of the office action, the examiner states that the object or goal of the present invention relating to the subject matter claimed in claim 1 is irrelevant.

Applicant respectfully disagrees. The main goal of the present invention is to connect the two parts 1 and 6, 28 to one another such that they remain securely attached and will not become detached when used (a permanent adhesive connection, as claimed). The problem the inventor was faced with is that the part 6, 28 is comprised of a material (polyfluorocarbon) that, as is well known in the art, has strong anti-adhesive properties. The plasma treatment inventively applied to the part 6, 28 enables joining of the support 1 and of the part 6, 28 to form a component having a permanent adhesive connection between the parts 1 and 6, 28. The support 1 and the part 6, 28 are fixedly connected to one another even though the part 6, 28 is comprised of an anti-adhesive material.

It is moreover an important goal of the present invention to provide a component comprised at least of two parts 1 and 6, 28 of which one part 6, 28 is comprised of the anti-adhesive material (polyfluorocarbon) in such a way that the parts will not become detached from one another, i.e., they are permanently connected to one another and inseparable.

It is therefore an important property of the component that it is made of the two aforementioned parts and that these parts in the finished component have a permanent adhesive connection and can no longer become separated from one another.

On page 3, third and fourth paragraphs, of the office action, the examiner states that applicant argues that in accordance with claim 1 of *Okumura* one surface is plasma treated and a fluorine-resin is bonded thereto. This is not correct. The referenced paragraph deals exclusively with claim 1 of the present invention. Applicant sets forth in the last sentence of this paragraph what the difference is between the prior art (providing water repellency) and the present invention. The invention is directed to **improving bonding** between parts of a component wherein at least one **surface to be bonded** is **comprised of poly fluorocarbon** and at least this one surface (**comprised of fluorocarbon polymer**) is **treated by plasma**. The examiners remarks in this context are not understood.

The cited prior art reference concerns a water-repellent coating on a surface of a component. The components that are mentioned in the cited prior art reference are a ship bottom surface, a toilet bowl, or a carbody. Further examples are given in col. 1, lines 9-23. Applying a water repellent coating has nothing to do with the present invention. In the cited prior art reference the object is to impart to the **exterior** of a finished component water-repellent properties. In the present invention, in contrast to this, two components are fixedly attached to one another and one of these elements or parts does not simply form a coating for the other. The support 1 is, for example, a support member of a rotary shaft seal and the part 6 is a sealing element in the form of a sealing lip; this is mentioned in the present specification.

In the cited prior art preference, first a matrix containing needles of a different material is applied to the component to be coated. The subsequent etching serves for exposing the needles by removing the matrix (the matrix has an etching rate that is, e.g., five times greater than that of the needles).

In the present invention, the surface of the part 6, 28 comprised of polyfluorocarbon is subjected to plasma activation in its connecting area 7. The resulting plasma-etched surface of the polyfluorocarbon part 6, 28 is applied to the other elements 1. In contrast to the cited prior art preference, the plasma-etched surface is not a structure that is secured in a matrix and is then exposed by removing the matrix. According to the present invention, the connecting surface of the part 6, 28 is subjected to plasma activation

wherein on the surface of the connecting area 7 the described sandblasting effect and chemical changes occur.

On page 3, last and second to last paragraphs of the office action, the examiner states that the surface according to Okumura is prepared by an etching process for the subsequent application of the coating. However, the etching process is not applied to a fluorocarbon part. The etching is carried out on a resin in order to expose needles of a different material. A fluorine containing coating is then applied to the thus prepared needle surface.

On page 4, first and second paragraphs, the Examiner states that the argument that the present invention relates to etching a polyfluorocarbon material is not persuasive because the cited prior art reference does not say that the base material is not an F resin and that the applicant has not shown that etching the "F resin" (polyfluorocarbon) and then applying it to the substrate instead of etching the substrate produces any unexpected results.

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Firstly, it is clearly improper to evaluate the prior art preference based on what it **does not disclose**. If a feature is not disclosed in the prior art, the prior art simply does not teach this feature. The Examiner's position that what is not disclosed expressly in the cited prior art preference could however not be excluded and therefore can be inferred as being disclosed is an improper reading of the prior art reference. There is not the slightest suggestion that the prior art could even remotely concern polyfluorocarbon materials as a base material given that such materials are extremely water repellent - there would be no need to treat them any further. See attached data information available on the Internet from Berghof/America on Teflon® (trademark of the DuPont Company for fluorocarbon resins): fluorocarbons are extremely hydrophobic (water-repellent) and have very low adhesiveness.

It is exactly these properties that stand in the way of attaching fluorocarbon compounds to other materials and it is exactly the problem that is being solved with the present invention.

Moreover, in regard to not providing unexpected results, applicant would like to point to page 3, lines 7ff, of the specification where the unexpected results of the present

invention are disclosed in detail. Firstly, the advantages of employing plasma treatment are set forth: the plasma activation results in a micro sandblasting effect (plasma etching) and/or in chemical changes and the thus activated surface ensures a reliable and fixed connection to the support member without requiring prior art etching processes employing solvents or solutions. By means of the plasma activation, the very low adhesiveness of parts made from fluorocarbons is overcome. The plasma treatment process is environmentally friendly and requires no disposal of hazardous solutions or solvents. The manufacture of the component is simplified and it is moreover possible to connect the plasma-treated fluorocarbon part directly to the support member.

On page 4, central paragraphs, the examiner states that the needle-like surface of the prior art is similar to the micro-sandblasted surface resulting from the plasma treatment according to the invention. In the prior art the surface that is created by etching is comprised of individual needles of a first material that are embedded in a matrix of a second material that can be etched away from the needles. It is not understood how this can be in any way related to a micro sandblasting effect achieved by plasma-treating a homogenous fluorocarbon material of the connecting area 7 of the part 6, 28 that is plasma activated. The surface of this connecting area 7 is micro-sandblasted and/or chemically changed. With regard to the examiner's statement that the language "and/or" indicates alternative results, it is respectfully submitted that the first term is "and", i.e., the specification fairly discloses that micro sandblasting AND chemical changes occur. That there may be an alternative result, as indicated by "or", does not exclude both effects from occurring at the same time.

In col. 2, starting at line 42, of the cited prior art reference a detailed description is provided of the component that is being produced. According to this text portion, a finished component is used such as a carbody or toilet bowl. In the first step, the mixture of the curable or hardenable liquid is produced that contains needle-like or shaped material. This mixture is applied to the component. After hardening, this coating is etched such that the needle-shaped material is exposed on the surface of the coating. This has nothing in common with the present invention. An important difference resides already in that the prior art according to Okumura employs a finished product such as a toilet bowl or carbody

that is to be coated. In the present invention an article is produced, for example, a rotary shaft seal. This is carried out by joining support 1 and part 6, 28 by providing a fixed connection (permanent adhesive connection) between the parts. In the cited prior art reference, the component is not manufactured but the component is already finished and is coated. The present invention deals with the manufacture of an article (component) itself so that there is no similarity between the two products.

On page 5, at the center, the examiner states that is no difference in the final product which is being claimed as regards which of the parts is plasma-activated. This is not so. It is decisive for the component of the invention which of the parts is being plasma-activated. The component or part 6, 28 is made of an anti-adhesive material (very low adhesiveness). As explained in the introductory portion of the specification, the properties of such materials require rather drastic etching methods with aggressive solvents or agents in order to improve the adhesiveness or bonding ability of the surfaces of such parts.

It is therefore very important which of the parts is being plasma-activated. It must be the anti-adhesive part 6, 28. If the support 1, i.e., the other part of the component, were plasma-activated, the anti-adhesive properties of the part 6, 28 would still not allow a permanent and fixed connection to the support because the anti-adhesive properties prevent bonding of the part 6, 28 to the support 1. It is therefore the decisive feature of the present invention that of the two parts 1; 6, 28 the part 6,28 made of poly fluorocarbon is the parts that is being plasma-activated. The activation is NOT interchangeable.

At the bottom of page 5 of the office action, the examiner states that the micro sandblasting effect could also lead to a needle-shaped configuration of the plasma-activated surface. The examiner again ignores the fact that the prior art has a needle-shaped material embedded in a matrix. The needle-shaped structure at the exterior side is produced as the matrix is removed and needles are exposed during the etching process. The needles are merely "peeled" out of the matrix; their arrangement is already predetermined in the matrix coating. Only because two different materials are used and one has already a needle shape, the creation of such a needle structure is possible. Such a structure cannot be generated randomly by a plasma-etching process.

According to the present invention, the surface of the connecting area 7 of the part

6, 28 comprised of poly fluorocarbon is plasma-activated so that the described micro sandblasting effect on the surface occurs. This has nothing in common with exposing needles embedded in a matrix by etching away the less resilient matrix.

The component according to claim 1 requires that at least the connecting portion 7 of the part 6, 28 is comprised of anti-adhesive material poly fluorocarbon. The problem is to connect fixedly and permanently the support 1 and the part 6, 28 made of poly fluorocarbon that has very low adhesiveness. The two parts must be bonded to form a component whose connection between these two parts, despite the fact that the part 6, 28 is made of poly fluorocarbon, is fixed and inseparable. It is therefore a very decisive feature for the finished component that the connection between part 1 and the other part 6, 28 is such that these two components cannot become separated from one another. Therefore, it is mandatory that the plasma activation treatment is provided on the part 6, 28 comprised of poly fluorocarbon.

The cited prior art reference deals with coating of a finished component. In the present invention the goal is to produce a finished component by bonding two parts to one another. The coating according to *Okumura* has nothing in common with combining two components to produce a finished component as claimed in claim 1.

In summarizing the above, the present invention solves the problem of connecting permanently a support and a part comprised of poly fluorocarbon. The part comprised of poly fluorocarbon must be plasma-activated in order to overcome the anti-adhesive properties of the polyfluorocarbon part. In order for a plasma activation to be carried out, the part must have a certain physical thickness and presence so that it can be handled - a coating that is applied by coating methods such as forming a C and F containing gas into a plasma or baking a coating (i.e., a powder or a liquid is applied that is converted by heat into a film) or by producing a monomolecular film by chemical adsorption cannot be subjected to a plasma-activation process prior to being connected to the support since there is no physically handleable coating layer prior to the coating process being performed. Therefore, the component as claimed is not obvious in view of the prior art reference to *Okumura*.

**CONCLUSION**

In view of the foregoing, it is submitted that this application is now in condition for allowance and such allowance is respectfully solicited.

Should the Examiner have any further objections or suggestions, the undersigned would appreciate a phone call or e-mail from the examiner to discuss appropriate amendments to place the application into condition for allowance.

Authorization is herewith given to charge any fees or any shortages in any fees required during prosecution of this application and not paid by other means to Patent and Trademark Office deposit account 50-1199.

Respectfully submitted on November 10, 2003,

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GEH

Encl.: - time extension petition (1 sheet);  
- 2 sheets Berghof/America - Types of Teflon

Berghof/America: Types of Teflon



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Please update your records with our new address. Our phone and fax numbers will remain the same.

## Types of Teflon®

"Teflon®" is the registered trademark of the DuPont Company for its fluorocarbon resins. DuPont pioneered the use of Teflon® PTFE and FEP resins following the discovery that they could be made into articles having a combination of mechanical, electrical, chemical, temperature and friction-resisting properties unmatched by articles made of any other material. Teflon® fluorocarbon resins' unique combination of physical, electrical, and chemical properties have found application in nearly every field of modern industrial, scientific, and technological endeavor.

### PTFE

Structurally, there are different types of Teflon® resin. Teflon® PTFE resin is a polymer consisting of recurring tetrafluoroethylene monomer units with the formula:  $(CF_2-CF_2)_n$

The maximum molecular weight of this is greater than 90% crystalline TFE Polymer is about  $9 \times 10^6$ . PTFE displays a series of unique properties:

Nearly universal chemical resistance (exceptions: elemental fluorine,  $CF_3$ , molten alkali metals) Insoluble in all solvents below 300°C High service temperature stability up to 250°C Very low adhesiveness Very low friction coefficient Extremely hydrophobic Physiologically inert, contaminant free Very good electrical (high resistance) and dielectrical (very low dielectric number and loss factor) properties Nonflammable Highly weather resistant (UV resistant) Good mechanical properties: tough elastic, easily manufactured

These advantages of PTFE, especially its universal chemical resistance, are the reason labware and accessories made of PTFE or other fluorocarbon resins are a must in any laboratory. Its broad service temperature range and its unbreakability are further advantages of PTFE.

Stirrer blades, magnetic stir bars encapsulated in PTFE, joint sleeves, adapters and boiling accessories are just a few of the items available in PTFE along with standard Labware items such as Flasks, Bottles, Beakers, etc. They are indispensable if the chemical resistance of glass or rare metals does not suffice. Digestion in boiling hydrofluoric acid or boron trifluoride is possible as well as hot alkali-hydroxide melts.

Labware made of PTFE resists temperatures of -200°C without becoming brittle. The maximum service temperature is +250°C, (but 300°C is possible) for a short time period. PTFE is extremely nonadhesive. This is an advantage for working with lacquers, adhesives, resins and hydroscopic substances. PTFE is biologically inert. Therefore it is used in many applications in biology, microbiology, medicine, pharmacy and in the food industry.

Pure PTFE, because of its chemical resistance and its antiadhesive surface, prevents any sample contamination by abrasion or etching. Vessels made of PTFE therefore are absolutely necessary in trace element analysis methods.

The production of PTFE-ware is performed using the so called isostatic pressing process. PTFE powder is filled in forms and isostatically pressed at high pressures. The pressed parts are sintered at temperatures up to 400°C. The characteristics of the material are substantially influenced by the pressing and sintering process. Porous PTFE is made by controlled sintering of powders with defined particle sizes. Stock PTFE in rods, sheets, etc. are available for customer use. PTFE : *Teflon®*, *Hostaflon*, *Malon*, *Fluon*, *Polyflon*

### FEP

Similar properties are displayed by the Tetrafluoroethylene Hexafluoropropylene-copolymer FEP:  $[CF-(CF_3)-CF_2(CF_2-CF_2)_n]_m$

## Berghof/America: Types of Teflon

The molecular weight of this copolymer is 50,000 to 500,000 and the crystallinity is about 50%. The maximum service temperature of 205°C is lower than PTFE. FEP is thermoplastically moldable (injection molded at temperatures of 320°-360°C extruded at 350°C - 410°C) is translucent, flexible, and feels heavy because of its high density. *FEP : FEP-Resin. Teflon®. Nfl-n*

**PFA**  
Perfluoroalkoxy-polymers, PFA has the same advantages as PTFE Teflon® with the structure: [CF(OR<sub>n</sub>)-CF<sub>2</sub>(CF<sub>2</sub>-CF<sub>2</sub>)<sub>n</sub>]m OR<sub>n</sub> represents a perfluoroalkoxy group.

PFA can be melt processed (extruded). The chemical resistance is comparable to PTFE. PFA is translucent and slightly flexible. It has greater mechanical strength and higher temperature tolerance than PTFE. Its melting temperature is 305°C.

"PFA was first used in the semiconductor industry for injection molded wafer carriers and similar articles that resisted aggressive chemicals and high temperature chemical processing. Now, PFA is also considered to be the best Teflon® for semiconductor piping applications, and is accepted for both liquid reagents and UPDI water handling in advanced processing applications." *PFA : Teflon® PFA*

Reference: Burggraaf, P., *Semiconductor International*, July 1988, p.55.



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